# Clase 7 6 Septiembre 2021

Título de la nota 06/09/2021

Variables
- intensivas: T, P
  no son sumatorias
- extensivas: V, n
  si son sumatorias

extensivas → Intensivas

$$\frac{V}{n} = \frac{m^3}{mol} = \text{Volumen molar}$$

$P, \bar{V}, T \rightarrow$ gráfico 3

Dimensiones

↳ ? → 2 Dimensiones

Procesos termodinámicos

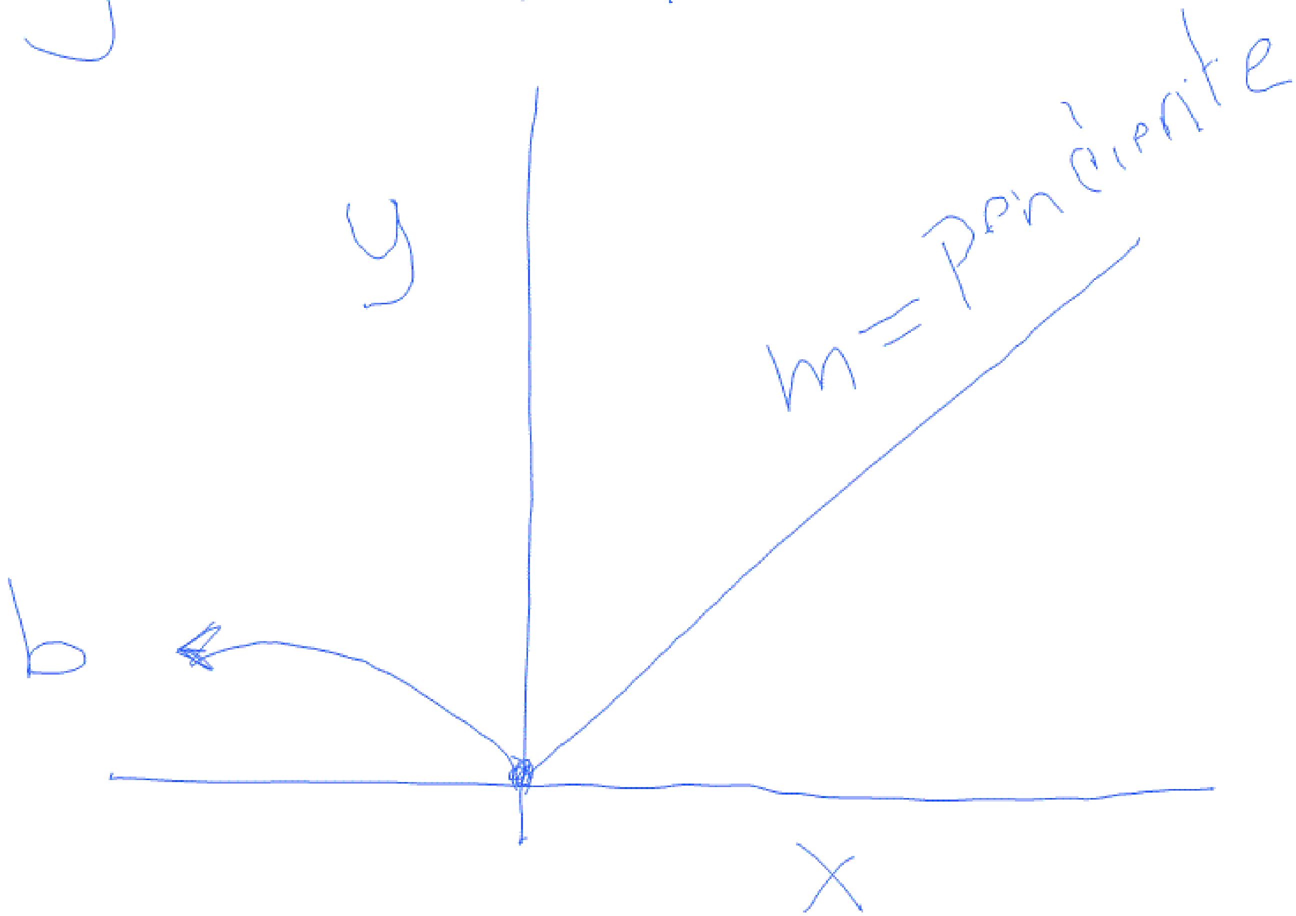
- Isobárico $p = cte$
- Isotérmico $= T = cte$
- Isocórico $= V = cte$

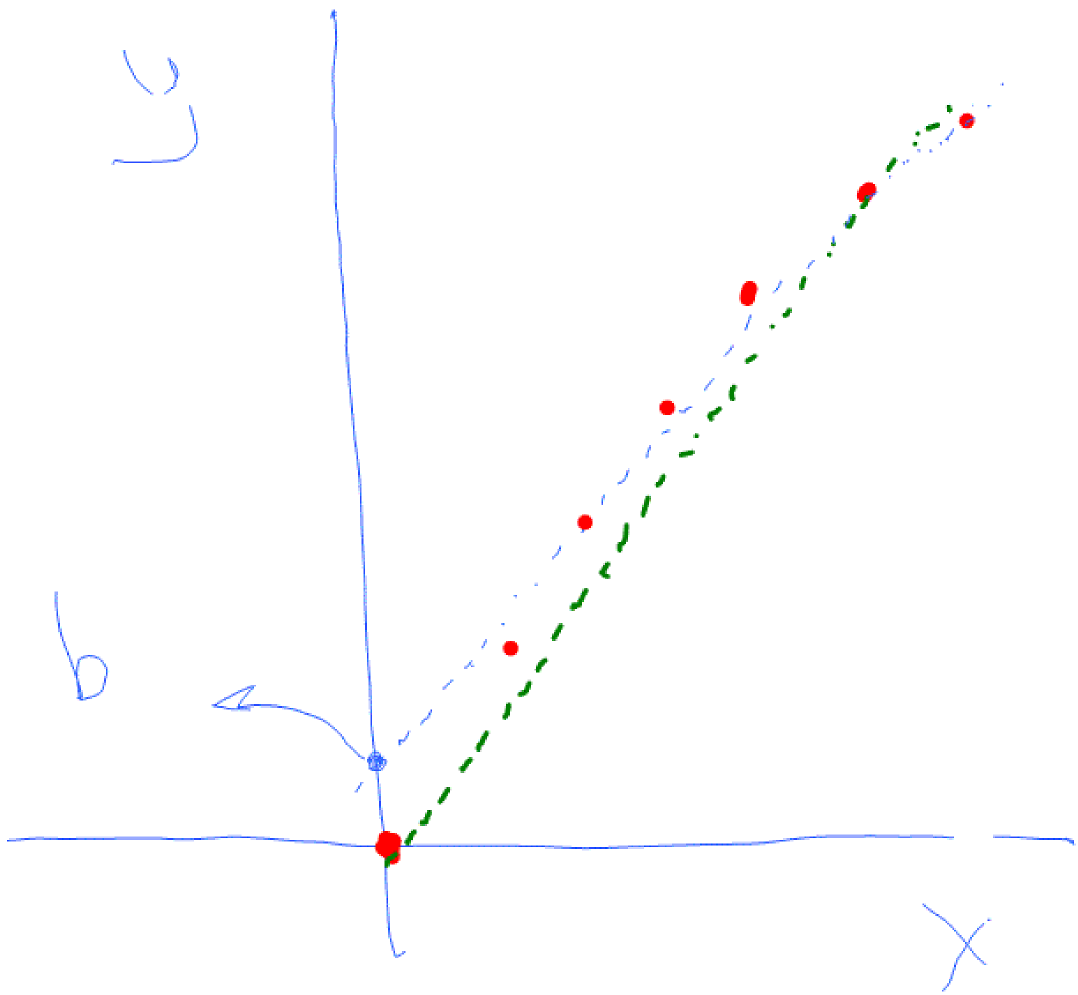
Adiabático $q = 0$ ⟶ T, P, V cambian

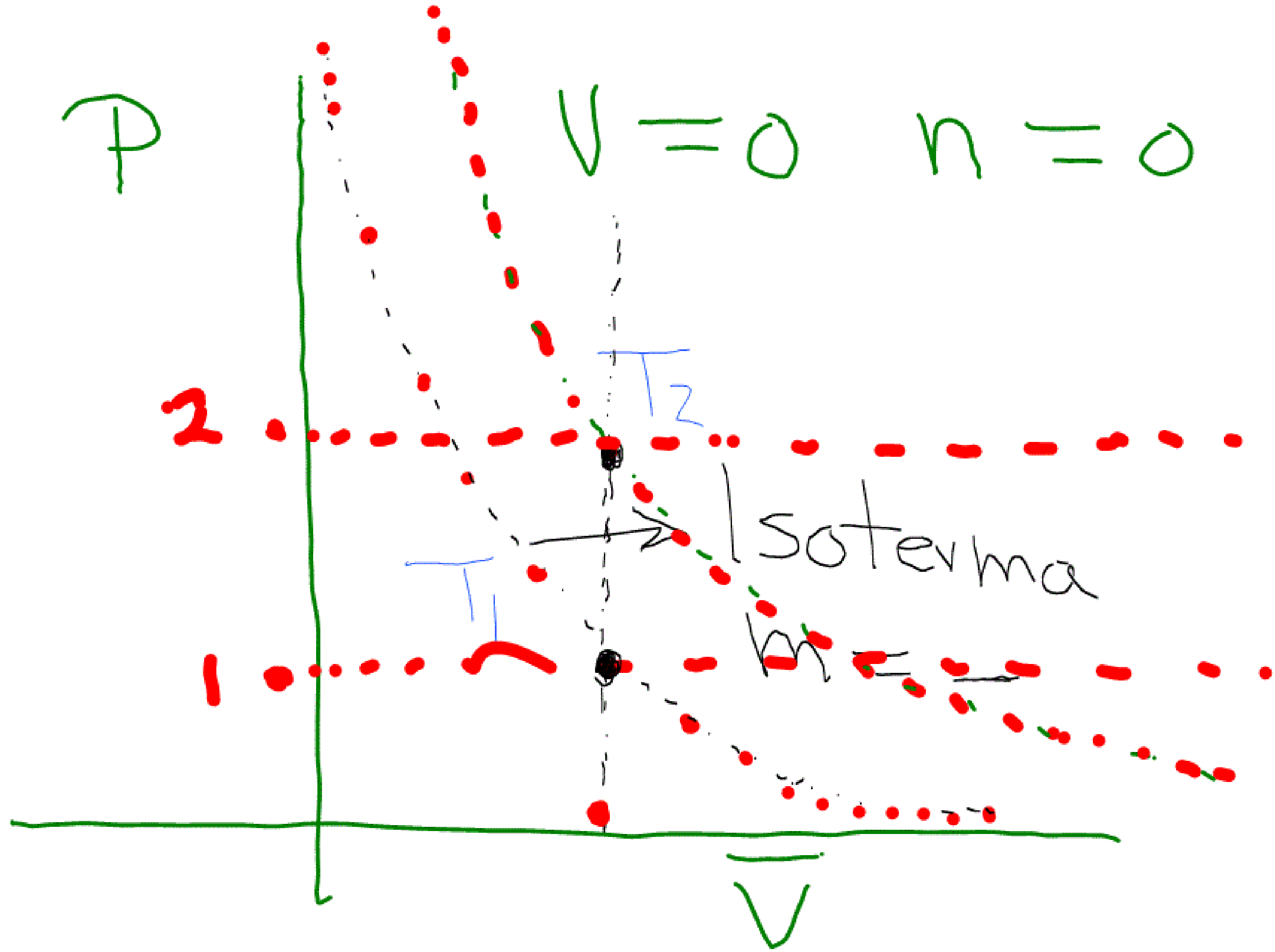
Variables
- dependientes: $(y)$
- independientes $(x)$

$y = f(x)$ ecuación

$$y = mx + b$$




y
b
x




$$P = f(\bar{V})$$

$$T_2 > T_1$$

# Ley Boyle

$$P \propto \frac{1}{V}$$

$$\boxed{V \propto \frac{1}{P}}$$

Ley Charles ✓

$V \propto T$

Ley Avogadro ✓

$V \propto n$

$$V = f(p, T, n)$$

$$dV = \left(\frac{\partial V}{\partial p}\right)_{T,n} dp + \left(\frac{\partial V}{\partial T}\right)_{p,n} dT + \left(\frac{\partial V}{\partial n}\right)_{T,p} dn$$

$$V \propto \frac{1}{P} \qquad V = \frac{k_1}{P}$$

$$V \propto T \qquad V = k_2 T$$

$$V \propto n \qquad V = k_3 n$$

$$\left(\frac{\partial V}{\partial P}\right)_{T,n} \qquad V = \frac{K_1}{P}$$

$$\left(\frac{\partial V}{\partial P}\right) = -\frac{K_1}{P^2}$$

$$V = k_2 T$$

$$\left(\frac{\partial V}{\partial T}\right)_{p,n} \left(\frac{\partial V}{\partial T}\right) = k_2$$

$$V = k_3 n$$

$$\left(\frac{\partial V}{\partial n}\right)_{P,T} \quad \left(\frac{\partial V}{\partial n}\right) = k_3$$

$$dV = -\frac{K_1}{P^2}\,dP + K_2\,dT + K_3\,dn$$

$K_1$ $K_2$ $K_3$

$$V = \frac{K_1}{P} \qquad V = K_2 T \qquad V = K_3 n$$

$$K_1 = PV \qquad K_2 = \frac{V}{T} \qquad K_3 = \frac{V}{n}$$

$$dV = -\frac{pV}{p^2}dp + \frac{V}{T}dT + \frac{V}{n}dn$$

$$dV = -\frac{V}{p}dp + \frac{V}{T}dT + \frac{V}{n}dn$$

$$\int\frac{dV}{V} = -\int\frac{dP}{P} + \int\frac{dT}{T} + \int\frac{dn}{n}$$

$$\ln V = -\ln P + \ln T + \ln n + \ln K$$

$$\ln V = \ln\left(\frac{nTK}{P}\right)$$

$$e \qquad e$$

$$K = R$$

$$V = \frac{nTK}{P}$$

$$V = \frac{nRT}{P}$$

Claussius

$$PV = nRT$$

Ley Conservación
energía

$$P = \frac{N}{m^2}$$

$$V = m^3$$

$$PV = \left(\frac{N}{m^2}\right)\left(m^3\right) = N \cdot m = J$$

Joule = energía

$$nRT = J$$

$$(mol)(R)(K)$$

$$R = \frac{J}{mol\,K}$$

$$nRT = (\cancel{mol})\left(\frac{J}{\cancel{mol}\,\cancel{K}}\right)(\cancel{K})$$

$$PV = nRT$$

$$J = J \quad \text{energía.}$$

$$P\bar{V} = RT$$

intensivo

$$R = \frac{J}{mol\,K}$$

equivalente mecánico del calor

$$\boxed{1\ cal = 4.186\ J}$$

# Condiciones normales

**Obtención de variables termodinámicas de acuerdo al modelo ideal**

Instrucción: Insertar los valores correspondientes en las celdas de color amarillo, dejando en blanco la variable a calcular

| p (atm) | n (mol) | R (atmL/molK) | T(K) | V (L) |
|---|---|---|---|---|
| 1 | | 0.082 | 273.15 | 22.4 |

| | | | | |
|---|---|---|---|---|
| presión | 0.000 atm | 0.00 kPa | 0.0000e+0 $N/m^2$ | 0.0000 bar |
| moles | 1.000 mol | | | |
| Temperatura | 0.00 K | 0.00 °C | 0.00 °F | |
| Volumen | 0.0000 L | 0.0000 $m^3$ | 0.00 mL | |

modelo ideal pV=nRT

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Con apoyo del programa UNAM-DGAPA-PAPIME PE-200419

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$$1.01325\ \text{bar} = 1\ \text{atm}$$

$$(1\ \text{bar})\left(\frac{\text{atm}}{1.01325\ \text{bar}}\right)$$

$$0.9869\ \text{atm} = 1\ \text{bar}$$

$P = 1\,atm$

$V = 22.4\,L$

$n = 1\,mol$

$T = 273.15\,K$

$R = ?$

$$PV = nRT$$

$$R = \frac{PV}{nT}$$

$$R = \frac{(1\,atm)(22.4\,L)}{(1\,mol)(273.15\,K)} = \frac{0.082\,atm\,L}{mol\,K}$$

$$\left(0.082\ \frac{atm\ L}{mol\ K}\right)\left(\frac{1.01325\times10^{5}\ N/m^2}{atm}\right)\left(\frac{m^3}{10^3\ L}\right)$$

$$N \cdot m = J$$

$$\left(8.2\times10^{-2}\ J\right)\left(1.01325\times10^{2}\right)$$

$$R = 8.314\ J/mol\,K$$

## Obtención de variables termodinámicas de acuerdo al modelo ideal

Instrucción: Insertar los valores correspondientes en las celdas de color amarillo, dejando en blanco la variable a calcular

| p (atm) | n (mol) | R (atmL/molK) | T(K) | V (L) |
|---|---|---|---|---|
| 0 | 1 | 0.082 | 273.15 | 22.4 |

| | | | | |
|---|---|---|---|---|
| presión | 1.000 atm | 101.12 kPa | 1.0132e+5 $N/m^2$ | 1.0132 bar |
| moles | 0.000 mol | | | |
| Temperatura | 0.00 K | 0.00 °C | 0.00 °F | |
| Volumen | 0.0000 L | 0.0000 $m^3$ | 0.00 mL | |

modelo ideal pV=nRT

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$$\left(\frac{8.314\ J}{mol\,K}\right)\left(\frac{1\ cal}{4.186\ J}\right)$$

$$\frac{1.9861\ cal}{mol\,K}$$